poisonous than the salts of calcium or magnesium. Prof. Jeffrey outlines an anatomical clue to the phylogeny of the monocotyledons which would derive them from dicotyledons. A suggestive paper by Prof. Toumey discusses the initial root system of tree seedlings.

THE latest addition to the useful series of short scientific memoirs published in Paris by M. C. Naud under the name *Scientia* is by Dr. L. Décombe, and is entitled "La Compressibilité des Gaz Réels." This is the twenty-first volume in the series dealing with physical and mathematical subjects.

THE Cambridge University Press has published the second part of vol. ii. of the "Reports of the Cambridge Anthropological Expedition to Torres Straits," which deals with physiology and psychology. The fasciculus contains sections by Mr. Charles S. Myers on hearing, smell, taste and reaction-times, and by Mr. W. McDougall on cutaneous sensations, muscular sense, and variations of blood-pressure.

THE decision of the Government to continue the present temporary Vaccination Act for one year has met with the approval of conscientious objectors, whose case Mr. Alexander Paul appears to take up in his little book, "The Vaccination Problem in 1903, and the Impracticability of Compulsion," recently published by Messrs. P. S. King and Son. The book should be useful in making clear the position of the objectors, so that the difficulties they put forward can be satisfactorily met when occasion requires it.

THE Orient-Pacific Line have published their pleasure cruise arrangements for the forthcoming Norway season. Three steamers will be employed, viz. the *Orient*, the *Cuzco* and the *Ophir*. The cruises begin on June 11, and vary in length from twenty to twenty-eight days. In addition to the attractions of Norwegian scenery and the Midnight Sun, the programme includes a visit to the glaciers of Spitsbergen with a prospect of seeing the Polar pack.

MR. A. R. HINKS writes in the *Monthly Review* for May on the evidence for life on Mars, and his article is illustrated by two maps of the canals or channels observed by Schiaparelli. The article is largely taken up with an account of Mr. Percival Lowell's observations of Mars at Flagstaff, in Arizona, and the conclusions drawn by Mr. Lowell, following a suggestion of Schiaparelli, as to the existence on Mars of a great irrigation system.

THE report of the council of the Hampstead Scientific Society for the year 1902 shows that the association continues its commendable activity. Among the lectures organised by the Society during the year may be mentioned those of Prof. Boyd Dawkins, F.R.S., on the forest primeval of the Coal-measures; Mrs. Dr. Bryant, on bees as builders of the honeycomb and otherwise; and Dr. Shenton, on medical applications of Röntgen rays. But much of the useful work of the Society is accomplished in sectional meetings, which are held in connection with the astronomical, the natural history, and the photographic sections two or three times a month. The example set by the Hampstead Society might with advantage be more widely copied.

CONSIDERABLE evidence is being accumulated at the present time which is apparently strongly antagonistic to the view that electrically charged ions are the factors which are directly active in all cases of chemical change. In the March number of the *Journal of Physical Chemistry*, Mr. H. E. Patten gives an account of experiments on the interaction of metals and hydrochloric acid in various perfectly anhydrous solvents. The solvents employed were benzene, chloroform, tin and silicon tetrachlorides, phosphorus and arsenic trichlorides, antimony pentachloride, sulphur monochloride, and thionylchloride. These solvents had a smaller conductivity than air, and yet zinc was in all cases directly acted upon by the acid.

AN interesting study of the modifications of acetaldehyde is the subject of a paper by R. Hollmann in the *Zeitschrift für physikalische Chemie*. Experimental data are given which show clearly the relationships existing between acetaldehyde and paraldehyde for temperatures ranging from −100° C. to 300° C. Of special interest are the observations relating to the composition of the liquid substance in its natural state of equilibrium. At the melting point (6·75° C.) the liquid consists of 88·3 per cent. of molecules of paraldehyde, whilst at the boiling point (41·6° C.) the molecular proportion is 53·4, and at the critical temperature (217° C.) only 11 per cent.

THE additions to the Zoological Society's Gardens during the past week include a Two-spotted Paradoxure (*Nandinia binotata*) from West Africa, presented by Mr. H. R. Harger; a Springbok (*Gazella euchore*) from South Africa, two Feline Douroucoulis (*Nyctipithecus vociferans*) from Southern Brazil, two Violet-necked Cassowaries (*Casuarius violicollis*) from the Aru Islands, four White-eared Bulbuls (*Pycnonotus leucotis*), an Indian Python (*Python molurus*), four Saccobranchs (*Saccobranchus fossilis*) from India, three Grey-breasted Bullfinches (*Pyrrhula griseiventris*) from Japan, three Mocassin Snakes (*Tropidonotus fasciatus*) from North America, five Red-spotted Lizards (*Eremias rubropunctata*) from Egypt, a Delalande's Gecko (*Tarentola delalandii*) from West Africa, deposited; a Diamond Snake (*Python spilotes*), three Brush Turkeys (*Talegalla lathami*) from Australia, purchased; on Axis Deer (*Cervus axis*), eight American Timber Wolves (*Canis occidentalis*), two Crab-eating Raccoons (*Procyon cancrivorus*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

A NEW COMET.—A telegram received from the Kiel Centralstelle informs us that Mr. Grigg, observing at Mr. Tebbutt's observatory, Windsor, New South Wales, discovered a new comet on April 17. The position of this object at 6h. 44m. 2s. (M.T. Windsor) on April 27 was:—

R.A. = 4h. 3m. 24s.
Dec. = 16° 23′ 25″ south.

The daily movement in R.A. is +1° 26′, and in declination +0° 27′; the announcement says nothing about the comet's brightness.

The above position is a little s.f. of γ Eridani.

NOVA GEMINORUM.—A telegram received from Prof. E. C. Pickering on April 22, published in No. 3864 of the *Astronomische Nachrichten*, states that "the light of Nova Geminorum is increasing."

THE PARTIAL ECLIPSE OF THE MOON ON APRIL 11.—The most striking feature of this eclipse was the blackness of the eclipsed surface, for it was not possible to see any of the details on that portion of the surface which was covered by the shadow. In a paper published in No. 16 (1903) of the *Comptes rendus*, M. Montangerand describes the results of the attempts he made to photograph that portion of the lunar surface eclipsed by the earth's shadow.

Using the astrographic-chart telescope and Lumière plates, and giving an exposure of one second to each plate, he obtained eleven negatives, two of which, Nos. vii. (Lumière "blue") and ix. (Lumière panchromatic), show the contour of the eclipsed moon, but no surface details.

The visual observations corroborate the photographs in showing that at this eclipse the shadow was especially black, so that no details of the eclipsed surface could either be seen or photographed. This result differs greatly from that recorded for the eclipses of December, 1898, and December, 1899, when the eclipsed surface was plainly visible and of a marked ruddy colour.

THE OCCURRENCE OF SPARK LINES IN ARC SPECTRA.—In a paper which recently appeared in the *Sitzungsberichte der K. Akademie zu Berlin* (January 22), Messrs. J. Hartmann and G. Eberhard give the results of a number of experiments they have made in order to determine under what conditions various lines, usually associated with spark spectra, may appear in the spectrum of the arc.

In the cases of magnesium and silicon—which are so important when considering stellar spectra—the authors found that when the arc was produced under water, using metallic poles, the magnesium line at λ 4481 and the silicon lines at λλ 4128 and 4131 were produced, although all three are usually called "spark" lines. In the case of zinc, the "spark" lines at λλ 4912 and 4925 were obtained under similar conditions.

The authors have also photographed the spectra of these metals when the arc was enclosed in an atmosphere of hydrogen, and again, under these conditions, the "spark" lines appeared. From this similarity of the results Messrs. Hartmann and Eberhard arrive at the conclusion that, when the arc is struck under water, it immediately becomes surrounded by an atmosphere of hydrogen, produced by the decomposition of the water, and so the same results under the two different primary conditions are obtained (*Astronomische Nachrichten*, No. 3858).

FOUR STARS WITH VARIABLE RADIAL VELOCITIES.—In *Bulletin* No. 31 of the Lick Observatory, Mr. H. M. Reese announces the discovery of four more stars having variable velocities in the line of sight; they are as follows:—

υ Andromedae.—Plates secured on October 8 and November 5, 1902, and January 14, 1903, show velocities of −17 km., −76 km., and +49 km. respectively. The spectrum shows few lines, and the hydrogen lines are broad, but the helium lines are fine and easily measurable.

π⁴ Orionis.—The plates obtained on October 6, 1902, January 4 and January 12, 1903, indicate velocities of +43 km., ±0 km., and +6 km. respectively, the spectrum being similar to *υ* Andromedæ.

σ Geminorum.—Velocities of +74 km., +12 km., +9 km. and +69 km. are indicated by negatives obtained on March 16, 1902, January 12, 13, and February 15, 1903, respectively. The lines, though numerous, are rather hazy, but they give trustworthy results.

ι Argus.—The variable velocity of this star was discovered by Prof. Campbell from the comparison of a plate obtained on February 21, 1898, with previous measures. A series of seven photographs obtained between February 23, 1897, and February 18, 1902, shows a range of velocity from +41·9 km. to +50·3 km.

The photographs mentioned above have been obtained with the Mills spectrograph, and measured by Messrs. Reese and Curtis. Mr. Reese also announces that the star ϕ^2 Orionis is an especially interesting object on account of its great radial velocity, plates obtained on October 28, November 24, and December 30, 1902, indicating velocities of +94 km., +102 km., and +96 km. respectively. The range of 8 km. may not be taken as indicating a variable velocity for this star, for although the photographs show fairly good lines, the second one—in which the variation appears—was very much under-exposed.

THE HARVARD MERIDIAN PHOTOMETER OBSERVATIONS.—Part ii. vol. xliv. of the Harvard College Observatory *Annals* is devoted to a description of the reduction of the observations made with the meridian photometer during the years 1892–98. The editor, Prof. E. C. Pickering, gives a detailed description of the meridian photometer and the methods pursued in making the observations. This description is followed by tables giving the results of the observations of Harvard photometer and A.G. catalogue stars made during the period named above, each table being followed by voluminous notes as to the peculiarities of the observed objects and the observing conditions.

ENGINEERING EDUCATION ABROAD.

THE conditions governing the competition among the great manufacturing countries for the markets of the world have, during the last thirty years, undergone profound modification. At the beginning of the latter half of last century British manufacturers held an unique position which secured for them what was practically the monopoly in some departments of the world's trade. The reasons for this fortunate position are too well known to require elaborate recapitulation. It is enough to remember that while other countries were on one hand engaged in war and on the other in maturing a stable and enduring constitution, Britain was establishing flourishing manufacturing centres, which, with the assistance of her possession of coal and iron, supplemented as it was by the natural endowments of her citizens so far as perseverance and inventiveness were concerned, resulted in her becoming the world's workshop. In no direction was this supremacy more pronounced than in the several branches of the engineering trades. But since then great changes have taken place. By carefully laid plans and persistent effort, other countries have succeeded in overcoming their disadvantages, and as a result of the provisions they have made for the education of their young men in scientific technology, the British manufacturer has now to reckon with formidable German and American competitors.

The changed conditions have been made the subject of study by several authorities in this country, one of the most recent being Prof. W. E. Dalby, who has studied the question of the education provided for engineers in America, Germany and Switzerland. The opportunity which his commission from Mr. Yarrow to report on the training of engineers in other countries has given Prof. Dalby make the recent papers read by him before the Institution of Naval Engineers and the Institution of Mechanical Engineers of exceptional value, and it is much to be hoped that the following facts from his papers, and the lessons to be drawn from them, may have a good effect in convincing our manufacturers and educational authorities that the higher education of those engaged in industrial pursuits has a direct and immediate effect on success in the struggle for commercial supremacy.

The paper read before the Institution of Naval Architects was concerned only with the education of engineers in the United States; that before the Institution of Mechanical Engineers included a study of the question in Germany and Switzerland also. It will be most convenient to take these countries in order. Beginning with the United States, the nature of the technical education in the best colleges may first be considered, and then the relation between the employers and the technically trained men graduating from these colleges.

America.—A good idea of the aims of the technical colleges of America may be gathered from the words of one of the chief founders of the Massachusetts Institute of Technology of Boston, who laid it down that the most truly practical education, even in an industrial point of view, is one founded in the thorough knowledge of scientific principles, which unites with habits of close observation and exact reasoning a large general cultivation. The highest grade of scientific culture is not too high a preparation for the labours of the mechanic and manufacturer, and there are in the history of social progress ample proofs that the abstract studies and researches of the philosopher are often the most beneficent sources of practical discovery and improvement.

Inspired by such enlightened views of technical education, it is not surprising that there has been a steady increase in the number of engineering students in the chief American colleges. The first table on p. 18 gives an idea of the growth of their engineering departments.

At Cornell University students of mechanical engineering and the allied branches do their work at Sibley College; there is a separate building for civil engineering and architecture. Sibley College is divided into eight departments, viz. mechanical engineering, mechanical laboratory instruction, electrical engineering, mechanic arts (workshops), industrial drawing and art, machine design, graduate schools of marine engineering, and the graduate school of railway mechanical engineering.